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Imaging the charge profile of graphene in quantum Hall states YONGTAO CUI, ERIC MA, GEORGI DIANKOV, FRANCOIS AMET, Stanford Univ, VITTO HAN, Columbia Univ, MICHAEL KELLY, DAVID GOLDHABER-GORDON, Stanford Univ, CORY DEAN, Columbia Univ, ZHI-XUN SHEN, Stanford Univ — Under quantum Hall conditions, discrete energy levels (Landau levels) form in a two dimensional electron gas (2DEG) system. Spatial reconstructions of carriers due to electrostatics can occur for a non-uniform charge profile, giving rise to highly insulating incompressible regions. In this work we use microwave impedance microscope to image the quantum Hall states in graphene devices. First, scanning images clearly show dividing regions of insulating bulk and conductive edges. We study the evolution of the edge patterns as the carrier density is tuned through multiple Landau levels. Furthermore, a finite voltage bias on the tip can induce a local charge perturbation, which leads to an extra incompressible ring that moves along with the tip during scanning. Such incompressible ring can be used to probe the variations of the local carrier profile. Our results indicate that the carrier density in graphene tuned by the back gate tends to increase toward the edge due to electrostatic screening. This is in contrast to the case of conventional semiconductor 2DEG systems, where the carrier density always decreases toward the edge due to charge depletion. We will discuss how this charge profile affects the formation of the incompressible stripes.

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